(i) providing said aqueous solvent in an amount resulting in complete hydrolysis and providing said acid in an amount maintaining a hydrolyzed precursor and avoiding gelation or precipitation; and

(ii) providing said surfactant and said silica precursor in a mole ratio that is above a lower mole ratio that produces a non-porous silica phase and below an upper mole ratio that produces a lamellar phase.

2. The method as recited in claim 1, wherein said lower mole ratio is about 0.05.

3. The method as recited in claim 1, wherein said upper mole ratio is about 0.3.

4. The method as recited in claim 1, wherein said acid is added in an amount resulting in a pH of said silica precursor solution of from about 1 to about 4.

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5. The method as recited in claim 4, wherein said pH is about 2.

6. The method as recited in claim 1, wherein the step of forming includes diluting with an alcohol.

7. The method as recited in claim 6, wherein said alcohol is ethanol.

8. The method as recited in claim 1, wherein said aqueous solvent, said acid, and said surfactant are premixed before combining with said silica precursor.

9. The method as recited in claim 1, wherein said mesoporous material is in a geometric form selected from the group consisting of fiber, powder, and film.

10. The method as recited in claim 1, wherein said forming is spin-casting.

11. The method as recited in claim 1, wherein said forming is spraying.

12. The method as recited in claim 1, further comprising adding a pre-polymer or a polymer to said silica precursor solution making a pituitous mixture.

13. The method as recited in claim 1, wherein said forming is drawing.

14. The method as recited in claim 1, wherein said forming is squeegeeing.

15. The method as recited in claim 1, further comprising the step of adding a metal compound to the silica precursor solution.

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16. The method as recited in claim 15, wherein said metal compound is selected from the group consisting of metal halide, metal nitrate, and combinations thereof.

17. The method as recited in claim 16, wherein said metal halide is a metal chloride.

18. The method as recited in claim 16, wherein said metal is selected from the group of aluminum, iron and combinations thereof.

19. The method as recited in claim 1, wherein said silica precursor is an alkoxide silica precursor or a tetrachlorosilane.

20. The method as recited in claim 1, wherein said aqueous solvent amount is characterized by a ratio of said aqueous solvent to said silica precursor of about 7.

21. The method as recited in claim 1, wherein said acid amount is characterized by a ratio of said acid to said silica precursor of about 0.1.

22. The method as recited in claim 1, further comprising adding a swelling agent to the silica precursor solution.

23. The method as recited in claim 22, wherein said swelling agent is 1,3,5-trimethylbenzene.

24. The method as recited in claim 1, further comprising the step of calcining the mesoporous material.

25. A method of making a mesoporous silica film, comprising the steps of

(a) combining a silica precursor with an aqueous solvent, an acid and a surfactant having an ammonium cation into a silica precursor solution,

(b) templating the silica precursor with the surfactant and obtaining the mesoporous material from the templated silica precursor,

(c) forming said silica precursor into a preform; and

(d) rapidly evaporating said aqueous solvent from said preform for obtaining the mesoporous material, wherein the improvement comprises:

(i) said silica precursor is tetraethoxysilane;

(ii) providing said aqueous solvent in a superstoichiometric amount and providing said acid in an amount maintaining a hydrolyzed precursor and avoiding gelation or precipitation;

(iii) providing said surfactant and said silica precursor in a mole ratio that is above a lower mole ratio that produces a non-porous silica phase and below and upper mole ratio that produces a lamellar phase; and

(iv) said forming includes diluting with an alcohol.

26. The method as recited in claim 26, further comprising adding a pre-polymer or a polymer to said silica precursor solution making a pituitous mixture.

27. The method as recited in claim 26, wherein said rapidly evaporating is by spin-casting.

Cancel claims 28-39, without prejudice.

40. (Twice amended) A method of making a mesoporous film on a substrate, the method comprising the steps of:

(a) combining a silica precursor with an aqueous solvent, an acid catalyst and a cationic surfactant into a precursor solution;

(b) dispensing said precursor solution onto the substrate;

(c) forming a film by evaporation of the solvent in less than approximately 5 minutes; and

(d) heating the film on the substrate to a temperature sufficient to decompose the surfactant, thereby producing a mesoporous film on the substrate.

41. The method of claim 40 wherein the precursor solution is a silica precursor solution and wherein the surfactant and the silica precursor solution are in a mole ratio that is above a lower mole ratio that produces a non-mesoporous silica phase and below an upper mole ratio that produces a lamellar phase.

Cancel claims 42-57, without prejudice.

58. (Twice amended) A process to form mesostructured films, comprising:

(a) preparing a precursor sol containing a soluble source of a silica-based metal oxide, an aqueous solvent, surfactant and acid catalyst; and

(b) depositing the precursor sol on a substrate wherein evaporation of solvent and water in less than 5 minutes causes the formation of said mesostructured films on the substrate surface.

59. (Amended) The process of claim 58 wherein the aqueous and the catalyst are provided in amounts that maintain a hydrolyzed precursor sol while avoiding gelation or precipitation.

60. (Amended) The process of claim 58 wherein the soluble source of silica is an alkoxide and wherein the surfactant and the soluble source of silica are in a mole ratio that is above a lower mole ratio that produces a non-porous silica phase and below an upper mole ratio that produces a lamellar phase.

Cancel claims 61-68, without prejudice.

69. (Amended) The process of claim 58, wherein the surfactant includes a cationic surfactant.

70. (Amended) The process of claim 58, further comprising the step of calcining said film at approximately 450°C.

71. (Amended) The process of claim 58, wherein the precursor sol is deposited on a substrate by spin coating.

Cancel claims 72-77, without prejudice.

78. (New) The process of claim 58, wherein said soluble source is an alkoxide precursor.

79. (New) A process to form a mesoporous structure, comprising:

(a) preparing a precursor sol containing a soluble source of a silicon or silicon-aluminum oxide, an alcohol and water solvent, surfactant, and acid catalyst, wherein said solvent is provided in an amount resulting in complete hydrolysis and said acid is in an amount to maintain a hydrolyzed precursor and to avoid gelation or precipitation in said precursor sol;

(b) forming the precursor sol into a preform;

(c) evaporating said solvent from the preform at a rate that forms a mesostructured material; and

(d) calcining the mesostructured material to form a mesoporous structure.

80. (New) The process of claim 79, wherein said precursor sol contains alcohol which is a byproduct of hydrolysis, and said mesoporous structure is a film.

81. (New) The process of claim 79, wherein said preform is a droplet, said alcohol is a byproduct of hydrolysis, and said sol is spray dried to form a powder.

82. (New) The process of claim 79, wherein said drying is preformed in less than 5 minutes.

83. (New) The process of claim 79, wherein said precursor sol contains dilutant alcohol, and wherein the mesostructure is a film.

84. (New) A process to form a mesoporous structure, comprising:

(a) preparing a precursor sol containing a soluble source of a silicon or silicon-aluminum oxide, an alcohol and water solvent, surfactant, and acid catalyst, wherein said solvent is provided in an amount resulting in complete hydrolysis and said acid is in amount to maintain a hydrolyzed precursor and to avoid gelation or precipitation in said precursor sol;

(b) forming the precursor sol into a preform;

(c) evaporating said solvent from the preform at a rate that forms a mesostructured material, wherein said mesostructured material contains surfactant and a silicate or aluminosilicate network; and

(d) calcining the mesostructured material to form a mesoporous structure.

85. (New) A process to form a mesostructure, comprising:

(a) preparing a precursor sol containing a soluble source of a silica-based metal oxide, water and alcohol solvent, surfactant and a catalyst; and

(b) evaporating said solvent in less than approximately 5 minutes to cause the formation of a mesostructure, wherein said mesostructure contains surfactant and a silicate network.

86. (New) The process of claim 79, wherein the said precursor sol contains alcohol which is a byproduct of hydrolysis, and wherein said mesostructure is a film.

87. (New) The process of claim 79, wherein said preform is a droplet, wherein said alcohol is a byproduct of hydrolysis, and wherein said precursor sol is spray dried.

88. (New) The process of claim 79, wherein said evaporating is performed in less than 5 minutes.

89. (New) The process of claim 79, wherein the surfactant includes a cationic surfactant and polyethelene oxide.

90. (New) The process of claim 79, wherein said soluble source of a silicon or silicon-aluminum oxide includes an alkoxide precursor.

91. (New) A process to form a mesostructure, comprising:

(a) preparing a precursor sol containing a soluble source of silica, a water and alcohol-solvent, surfactant and a catalyst, and

(b) evaporating said solvent in less than 5 minutes to cause the formation of a mesostructure.

92. (New) The process of claim 91, wherein said solvent is evaporated in less than approximately 1 minute.

93. (New) The process of claim 91, wherein said solvent is evaporated in less than approximately 10 seconds.

94. (New) The process of claim 91, wherein the said precursor sol contains both dilutant alcohol and alcohol which is a byproduct of hydrolysis, and said mesostructure is a film.

95. (New) The process of claim 91, wherein said preform is a droplet, said alcohol is a byproduct of hydrolysis, and said sol is spray dried.

96. (New) The process of claim 91, wherein the mesostructure is silicon-iron oxide or silicon-aluminum oxide.

97. (New) The process of claim 91, wherein the surfactant comprises CTAC and polyethelene oxide.

98. (New) The process of claim 91, wherein the surfactant is cationic.

99. (New) A process to form mesostructured films, comprising:

a) preparing a precursor sol containing a soluble source of silicon-metal oxide, water, alcohol, a cationic surfactant, and acid catalyst, wherein the surfactant concentration is less than the critical micelle concentration; and

b) depositing the precursor sol on a substrate wherein evaporation of alcohol and water causes the formation of said mesostructured films on the substrate surface.

100. (New) The process of claim 99 wherein said film is used as a low dielectric constant interlayer or coating.

101. (New) The process of claim 99 wherein said film is used for energy storage, catalysis, thermal barriers, or environmental remediation.

102. (New) The process of claim 99 wherein said silicon-metal oxide is silicon-aluminum oxide.

103. (New) The process of claim 99, wherein the sol is aged prior to film deposition to affect a change of the film microstructure.

104. (New) The process of claim 99 wherein the sol is aged for approximately 1 hour prior to film deposition.

105. (New) The process of claim 99, further comprising a step of calcining said mesostructured film on the substrate surface at approximately 450°C to form a mesoporous film.

106. (New) The process of claim 99 wherein said film exhibits an index of refraction of between approximately 1.14 and approximately 1.44.

107. (New) The process of claim 99 wherein the precursor sol is deposited on a substrate by drawing, squeegeeing, spraying or spin-coating.

108. (New) The process of claim 99 wherein said mesostructured films are identified by hexagonal XRD peaks diffraction patterns in the two theta range of approximately 2°-5.5°.

109. (New) The process of claim 40, wherein the film exhibits an index of refraction of between approximately 1.14 and approximately 1.44.

110. (New) The process of claim 58, wherein the films exhibit an index of refraction of between approximately 1.14 and approximately 1.44.

111. (New) The process of claim 79, wherein the mesoporous structure is a film and wherein the film exhibits an index of refraction of between approximately 1.14 and approximately 1.44.

112. (New) The process of claim 85, wherein the mesoporous structure is a film, and wherein the film exhibits an index of refraction of between approximately 1.14 and approximately 1.44.

113. (New) The process of claim 86, wherein the mesostructure is a film, and wherein the film exhibits an index of refraction of between approximately 1.14 and approximately 1.44.

114. (New) The process of claim 92, wherein the mesostructure is a film, and wherein the film exhibits an index of refraction of between approximately 1.14 and approximately 1.44.

115. (New) The process of claim 99, wherein the films exhibit an index of refraction of between approximately 1.14 and approximately 1.44.